

CL1747 USNA.txt
SEQUENCE LISTING

<110> DiCosimo, Deana J.
Ni, Hao
Ye, Rick
Picataggio, Stephen
Wang, Tao
Seip, John E.

<120> NATURAL PROMOTERS FOR GENE EXPRESSION IN C1 METABOLIZING BACTERIA

<130> CL1747 US NA

<150> 60/419,872

<151> 2002-10-21

<160> 26

<170> PatentIn version 3.2

<210> 1

<211> 1392

<212> DNA

<213> Methylomonas sp. 16a

```

<400> 1
atgaaaacca tcattagatc gagctcgaag aaattgttat tgacgttatc ggcttcgcta      60
gccgtttggg gtttgacgat tgcgcccgat gtcggggcag ttggcaagct ggaaaaggaa      120
gatttgaaat tcggcttcac caagctcacc gacatggcgc cgctggcggt ggccgccgaa      180
aaaggcttct tcgaggacga gggcctgttc gtgcaactgg aagcgcaggc caactggaag      240
gtggtgatgg atagggtcgt gaatggcgaa ctggacggct cgcacatgct ggcgccggcg      300
ccgttagcgg ccagcgttgg cttcggcacc aaggccgata tcgaggtgcc gttcagcatg      360
ggcttcaacg gcaacgcgat tacggtgtcc aatgaaatct ggcatcagat gaagccgaac      420
ataccgctgg aaggcggtaa accggtgcat ccgatcaagg cagattatct aaaaccggtc      480
gtcgaaaaat acaaagccga aggcaagccg ttcaatatgg cgatgacctt cccggccgga      540
tctcacaaca tcaaactgcg ttactggctg gcggtggcg gtatcaatcc tggctactat      600
tcgccgccgc aggacatttc cggccaaatc ggcgcagacg ccttgttgtc ggtgaccccg      660
ccgccgcaaa tgccgtccac gctggaagcc ggcaccattt tcggttattg cgtcggcgag      720
ccgtggaacc agcaggccgt gttcaagggc ataggcgtgc cggatgatcac cgatgaagaa      780
ctctggaagg acacgccgga aaaagtcttc ggcgtgacca aacaatgggc ggagaaatac      840
cccaacacct atctggcggg gaccaaggcg ctgattcggg ccgcgatctg gctggacgcc      900
gacaataaca agaaccgcaa ggaagccatc gaaatgctgg cgaaaaaca atacgtcggg      960
gctgacgtgg aagtgtggc ggctagcatg aacggcactt tcgaatacga aaaagacgat     1020
aaacgcgcgc taccggactt caacaccttc tttcgccacg gcgccagcta tccgtcctac     1080
agcagtgcag tctggtatct gaccagctg aggcgctggg gcatgatcaa tgaattcaaa     1140
ccggacaact ggtatctgga taccgccaag aacgtctacc gcccggacat ctatctcgcc     1200
gcggccaagg aactggtcgc agaaggcaag gccaaaggccg aagacttccc tgccgatacc     1260

```

CL1747 USNA.txt

tcgatcaagc cgtcgcagaa tttcttcacg gacaaagtgc cgttcgatgc caacaagccc 1320
 aacgattacc tcgccaagtt tgcgataggt ctgaaaggca agcaaaccgt agccggcggc 1380
 aaggctcgtgg at 1392

<210> 2
 <211> 464
 <212> PRT
 <213> Methylobionas sp. 16a
 <400> 2

Met Lys Thr Ile Ile Arg Ser Ser Ser Lys Lys Leu Leu Leu Thr Leu
 1 5 10 15
 Ser Ala Ser Leu Ala Val Trp Gly Leu Thr Ile Ala Pro Asp Val Gly
 20 25 30
 Ala Val Gly Lys Leu Glu Lys Glu Asp Leu Lys Phe Gly Phe Ile Lys
 35 40 45
 Leu Thr Asp Met Ala Pro Leu Ala Val Ala Ala Glu Lys Gly Phe Phe
 50 55 60
 Glu Asp Glu Gly Leu Phe Val Gln Leu Glu Ala Gln Ala Asn Trp Lys
 65 70 75 80
 Val Val Met Asp Arg Val Val Asn Gly Glu Leu Asp Gly Ser His Met
 85 90 95
 Leu Ala Pro Ala Pro Leu Ala Ala Ser Val Gly Phe Gly Thr Lys Ala
 100 105 110
 Asp Ile Glu Val Pro Phe Ser Met Gly Phe Asn Gly Asn Ala Ile Thr
 115 120 125
 Val Ser Asn Glu Ile Trp His Gln Met Lys Pro Asn Ile Pro Leu Glu
 130 135 140
 Gly Gly Lys Pro Val His Pro Ile Lys Ala Asp Tyr Leu Lys Pro Val
 145 150 155 160
 Val Glu Lys Tyr Lys Ala Glu Gly Lys Pro Phe Asn Met Ala Met Thr
 165 170 175
 Phe Pro Ala Gly Ser His Asn Ile Lys Leu Arg Tyr Trp Leu Ala Ala
 180 185 190
 Gly Gly Ile Asn Pro Gly Tyr Tyr Ser Pro Pro Gln Asp Ile Ser Gly
 195 200 205
 Gln Ile Gly Ala Asp Ala Leu Leu Ser Val Thr Pro Pro Pro Gln Met

210

215

220

Pro Ser Thr Leu Glu Ala Gly Thr Ile Phe Gly Tyr Cys Val Gly Glu
 225 230 235 240

Pro Trp Asn Gln Gln Ala Val Phe Lys Gly Ile Gly Val Pro Val Ile
 245 250 255

Thr Asp Glu Glu Leu Trp Lys Asp Thr Pro Glu Lys Val Phe Gly Val
 260 265 270

Thr Lys Gln Trp Ala Glu Lys Tyr Pro Asn Thr Tyr Leu Ala Val Thr
 275 280 285

Lys Ala Leu Ile Arg Ala Ala Ile Trp Leu Asp Ala Asp Asn Asn Lys
 290 295 300

Asn Arg Lys Glu Ala Ile Glu Met Leu Ala Gln Lys Gln Tyr Val Gly
 305 310 315 320

Ala Asp Val Glu Val Leu Ala Ala Ser Met Asn Gly Thr Phe Glu Tyr
 325 330 335

Glu Lys Asp Asp Lys Arg Ala Leu Pro Asp Phe Asn Thr Phe Phe Arg
 340 345 350

His Gly Ala Ser Tyr Pro Ser Tyr Ser Ser Ala Val Trp Tyr Leu Thr
 355 360 365

Gln Leu Arg Arg Trp Gly Met Ile Asn Glu Phe Lys Pro Asp Asn Trp
 370 375 380

Tyr Leu Asp Thr Ala Lys Asn Val Tyr Arg Pro Asp Ile Tyr Leu Ala
 385 390 395 400

Ala Ala Lys Glu Leu Val Ala Glu Gly Lys Ala Lys Ala Glu Asp Phe
 405 410 415

Pro Ala Asp Thr Ser Ile Lys Pro Ser Gln Asn Phe Phe Ile Asp Lys
 420 425 430

Val Pro Phe Asp Ala Asn Lys Pro Asn Asp Tyr Leu Ala Lys Phe Ala
 435 440 445

Ile Gly Leu Lys Gly Lys Gln Thr Val Ala Gly Gly Lys Val Val Asp
 450 455 460

<210> 3

<211> 551

<212> DNA

<213> Methylomonas sp. 16a

<220>
 <221> misc_feature
 <222> (409)..(411)
 <223> ATG start site of nrtA gene

<400> 3
 acacgctcaa gcgaaccacg cccaatttac tcatatgcct atgatttaaa tattgaaata 60
 aaattcatta gttccaaggt acgagcttgg cattgcgatt gcttgggata ttgtcagaaa 120
 taacttcctt gtgtatctcc tttcccagag aaggcggtcg taatccccct ctccccgcgg 180
 gtgcggagggg agaaggcact gttttgactc atccaacaga ggatgaggac gcacaatgcg 240
 gaagttattt ttgactgaat tattagtatc aatcagcact ccatcgtagg agtctgaatt 300
 ttcgctcacg ggtgagcaaa tcggacgaag gcgtctgtcg tgcattgctt ttggcaatga 360
 cacgcggacg ccttttttat tttccgccgt ttttgtttgg aactagtcac gaaaaccatc 420
 attagatcga gctcgaagaa attgttattg acgttatcgg cttcgctagc cgtttggggt 480
 ttgacgattg cgcccgatgt cggggcagtt ggcaagctgg aaaaggaaga tttgaaattc 540
 ggcttcatca a 551

<210> 4
 <211> 336
 <212> DNA
 <213> Methylomonas sp. 16a

<400> 4
 atgaaactca taacagcagt tgtaaagcca ttcaagctcg acgacgtccg tgaggcggtg 60
 tccgagattg gcgtatccgg ggtgacggtg accgaagtca agggcttttg ccgtcagaaa 120
 gggcataccg aactctatcg aggtgccgag tacgtagtcg atttcttgcc caaggccaaa 180
 atcgaagtgg cgggtggggga tgccttggtc gagcaggcgg tagagtccat cgtcaagggtg 240
 gccaataccg gcaaaaatcgg cgacggcaag attttcgtca ccaatttaga gcaggttgtc 300
 cggatcagaa ccggcgaatc cggcgaagac gcgctt 336

<210> 5
 <211> 112
 <212> PRT
 <213> Methylomonas sp. 16a

<400> 5
 Met Lys Leu Ile Thr Ala Val Val Lys Pro Phe Lys Leu Asp Asp Val
 1 5 10 15
 Arg Glu Ala Leu Ser Glu Ile Gly Val Ser Gly Val Thr Val Thr Glu
 20 25 30
 Val Lys Gly Phe Gly Arg Gln Lys Gly His Thr Glu Leu Tyr Arg Gly
 35 40 45
 Ala Glu Tyr Val Val Asp Phe Leu Pro Lys Ala Lys Ile Glu Val Ala
 50 55 60

CL1747 USNA.txt

Val Gly Asp Ala Leu Val Glu Gln Ala Val Glu Ser Ile Val Lys Val
65 70 75 80

Ala Asn Thr Gly Lys Ile Gly Asp Gly Lys Ile Phe Val Thr Asn Leu
85 90 95

Glu Gln Val Val Arg Ile Arg Thr Gly Glu Ser Gly Glu Asp Ala Leu
100 105 110

<210> 6
<211> 551
<212> DNA
<213> Methylobionas sp. 16a

<220>
<221> misc_feature
<222> (445)..(447)
<223> ATG start site of nitrogen regulating PII-protein (glnB) gene

<400> 6
gctttcgttc aaaataattc tctccgtcag ggaaaagaga ggctaggggg gttatccgaa 60
gcatttctgc aggcctatct tccatatggc tttcgtaaaa gatcaaagt agcttggatc 120
cgcgtcgcac aagtcaacga aatcagaatg ttgagatgca gtctaacctg gtttttgtga 180
tgcccgtctc aaagggtaaa gctgggaggga atttcgggtg tattgatgac acgttcctta 240
ttaatcccgt gcctgcgcaa aaagggcggg accaaaatga agcgccgtgc gccaagttgg 300
tgcttcaaaa tggggattgc aaacgggttt cataaaaagt cttttaataa caattgatta 360
tgtgttgcca tgtaacgtgc ttattcgtc gtgaagttaa tgacaagtcg ttttggggga 420
attaaccatg agaggtatca atttatgaaa ctcataacag cagttgtaaa gccattcaag 480
ctcgacgacg tccgtgaggc gttgtccgag attggcgtat ccgggggtgac ggtgaccgaa 540
gtcaagggtc t 551

<210> 7
<211> 693
<212> DNA
<213> Methylobionas sp. 16a

<400> 7
atgattttca agcaactttt cgaaaccgaa acatcgacct atagctatct gctgggctgt 60
gaacgcactc accgcgcgat tttaatcgat ccggctgcct cggaactgga tgactatatc 120
gatctgttga atagcctgac tctcaaattg atttataccc tggaaacgca cgttcattgcg 180
gaccacatca ccggctccgg actgctacgg caaaagcttg gcagcaaaaag tgcgtgcat 240
cgagatgcgg gcgcatgtg cgcggacctc ctggtcaccg atggcgtacc actgcaagtc 300
ggcgacctgg aattagaagt ccgacatacg cccggccaca ccaatggctg cgtcagttac 360
gtgatggccg accgggtctt caccggtgat gcactattga tcggcggcag cggccgtacc 420
gattttcaac aaggcgacgc tggccaactt tacgacagca tcaccggcaa gctgttcaca 480

```

ttgccacccg acaccctggt ttatcctgga caccgattaca acggcaacac cgtttccacg      540
atcaaacaag agatggccaa aaacacgcgc ttgggcggcg gcaaatacacg cgaggaattc      600
atcgccatcc tgcaagattt gaaactggct tatcccaagt tcatcgataa ggccttaccg      660
gccaatcaat cctgcggctt gatcgcacag ggt                                     693

```

```

<210> 8
<211> 231
<212> PRT
<213> Methylomonas sp. 16a

```

```
<400> 8
```

```

Met Ile Phe Lys Gln Leu Phe Glu Thr Glu Thr Ser Thr Tyr Ser Tyr
1      5      10      15

```

```

Leu Leu Gly Cys Glu Arg Thr His Arg Ala Ile Leu Ile Asp Pro Val
20      25      30

```

```

Ala Ser Glu Leu Asp Asp Tyr Ile Asp Leu Leu Asn Ser Leu Thr Leu
35      40      45

```

```

Lys Leu Ile Tyr Thr Leu Glu Thr His Val His Ala Asp His Ile Thr
50      55      60

```

```

Gly Ser Gly Leu Leu Arg Gln Lys Leu Gly Ser Lys Ser Val Val His
65      70      75      80

```

```

Arg Asp Ala Gly Ala Met Cys Ala Asp Leu Leu Val Thr Asp Gly Val
85      90      95

```

```

Pro Leu Gln Val Gly Asp Leu Glu Leu Glu Val Arg His Thr Pro Gly
100     105     110

```

```

His Thr Asn Gly Cys Val Ser Tyr Val Met Ala Asp Arg Val Phe Thr
115     120     125

```

```

Gly Asp Ala Leu Leu Ile Gly Gly Ser Gly Arg Thr Asp Phe Gln Gln
130     135     140

```

```

Gly Asp Ala Gly Gln Leu Tyr Asp Ser Ile Thr Gly Lys Leu Phe Thr
145     150     155     160

```

```

Leu Pro Pro Asp Thr Leu Val Tyr Pro Gly His Asp Tyr Asn Gly Asn
165     170     175

```

```

Thr Val Ser Thr Ile Lys Gln Glu Met Ala Lys Asn Thr Arg Leu Gly
180     185     190

```

```

Gly Gly Lys Ser Arg Glu Glu Phe Ile Ala Ile Leu Gln Asp Leu Lys
195     200     205

```

CL1747 USNA.txt

Leu Ala Tyr Pro Lys Phe Ile Asp Lys Ala Leu Pro Ala Asn Gln Ser
210 215 220

Cys Gly Leu Ile Ala Gln Gly
225 230

<210> 9
<211> 579
<212> DNA
<213> Methylobionas sp. 16a

<220>
<221> misc_feature
<222> (424)..(426)
<223> ATG start site of glyoxalase gene

<400> 9
gcctgctttg gactgatcga tagcttacgg cttacccccca aagtcattgca tgaaccctgt 60
cgatgatgtc atcgggtggac aacccaaacg atctccccct cctgtcgcaa caaagcttcg 120
ccatcggcct cggaccgcgc cggcatcgac tcattcaaaa agcttgagcc ttggtaaaag 180
tcgattgtat taagccagca ttgcaatga ctcatggcta gagccaccaa atgtttcaca 240
aacatttcaa atgaaacaca atcgtttcaa cacttcagcc tgaacaacc gagaaacaaa 300
cacttgaaaa agaagcagca aaatcaatac ataagcgcgt ggcaaggcct aaaaaaactg 360
gcacgggaat tgatataaga acatcaagct tttctaattt ttgttaaaac caggagccta 420
gtcatgattt tcaagcaact tttcgaaacc gaaacatcga cctatagcta ttgctgggc 480
tgtgaacgca ctaccgcgc gattttaatc gatccggtcg cctcggaaact ggatgactat 540
atcgatctgt tgaatagcct gactctcaaa ttgatttat 579

<210> 10
<211> 1932
<212> DNA
<213> Methylobionas sp. 16a

<400> 10
atgactgttg aagcaaaaaa agaaacctta ggctttcaaa ccgaagtga gcatctgttg 60
catttgatga ttcactcgtc atacagcaac aaggaaatct tcctgcgcga attgatttcc 120
aacgcctccg acgccgccga caaactgcgc ttcgaagcgc tggccaacga cagcctgtac 180
gaaggcgaca gcgaattgaa aatccgcgtc gatttcgacg aagcaaaaaa aaccatcacc 240
atcaccgata acggcatcgg catgagccgt gaggaagtgc aggaccatat cggcaccatc 300
gccaaatccg gcaccaagca attcttcgaa aaattgaccg gcgaccaggc caaggacagc 360
gagctgatcg gccagttcgg tgtcggtttt tattcggcct tcatcgtcgc cgacaaagtc 420
acgctgacga cccgcaaggc cggcgcgccg catgaccaag gcgtgcgctg ggaatccgac 480
ggcctgggag aatacagcat cgaaaccgtc gaaaaagctg gtcgcggcac cgaaatcgtg 540
ctgcatctga aagaaggcga agacgatttc ctgagcagct ggaagctacg ttccatcatc 600

CL1747 USNA.txt

```

aagaaataact ccgaccacat ctctttgccc atcatcatga gcaaggaaat cccggccgag 660
aaggacgacg acggcaacga aaccgcgccg gcccggtgctg aagacgaaac cgtcaacagc 720
gcctcggcct tgtggacaaa atccaaggac gacatcagcg cggaacagta caacgagttt 780
tacaacacag tcgcccacga cttccaggac ccgctgggtt acgttcatag caaagtcgaa 840
ggcaccaacg aatacacctt gttgctgtac gtccccggcc gggcgccgtt tgatttgtgg 900
gaccgcgacg ccaaacacgg cgtcaagctg tacatcaaga aagtcttcat caccgacgac 960
gccgaacaac tgatgccgcg ctacctgcgc ttcgtgcgcg gtatcgtcga tgccgacagc 1020
ttgccgctga acgtatcacg ggaaatcctg caacaaagca agcaaatcag cgcgatcaaa 1080
tccggcgcgg tgaaaaaagt gctgggcatg ctggaagaca tggccgagaa cgacgtcgag 1140
aaataccaaa aattctggga acagttcggc aacgtcatca aggaaggccc gatagaagac 1200
cacaaaaaca aagatcgcat cgccaacctg ttgcgtttct cgtcaacca tagcgacgac 1260
aaaacccaaa acgtgtcgct ggccgattat gtcagtcgca tgaaggaagg ccagaacaaa 1320
atctacttca tcaccgccga tagctatgcg gcggccaaaa acagcccgca tctggaagtg 1380
ttccgcaaaa aaggcctgga agtggtgctg ctgaccgacc gcatcgacga atggctggtg 1440
tccagcctga ccgaattcga cggcaagcac atgcaatcga tcgccaaagg cgaactggac 1500
ctggacaaat tcgacagcga agaagagaaa aaacaccagg aagaagtcag caaagacttc 1560
gaatcggtcg tcaagcaaat ccaggaagtg ctgaaagaca aagtcagcga agtgaataatc 1620
agccaccgcc tgaccgactc gccagcctgt ctggtgaccg gcgcctacga catgagcctg 1680
cacatggagc gcatcatgaa ggaagccggc cagccatga acatgatggg catgggcggc 1740
agcaagccga tcttcgaaat caaccggac cagccatcg tccaggccct gaaaaacgag 1800
caagacgaca cccgcttcgc cgacattagt cacatcctgt tcgatcaggc catcctcagc 1860
gaaggcggcc aactggacga cccggcgggc ttcgtgcata agctgaatgg cttgttgcaa 1920
ggtctactga ag 1932

```

```

<210> 11
<211> 644
<212> PRT
<213> Methylobionas sp. 16a

```

```
<400> 11
```

```
Met Thr Val Glu Ala Lys Lys Glu Thr Leu Gly Phe Gln Thr Glu Val
1          5          10          15

```

```
Lys His Leu Leu His Leu Met Ile His Ser Leu Tyr Ser Asn Lys Glu
20          25          30

```

```
Ile Phe Leu Arg Glu Leu Ile Ser Asn Ala Ser Asp Ala Ala Asp Lys
35          40          45

```

```
Leu Arg Phe Glu Ala Leu Ala Asn Asp Ser Leu Tyr Glu Gly Asp Ser
50          55          60

```


CL1747 USNA.txt

Glu Leu Lys Ile Arg Val Asp Phe Asp Glu Ala Lys Lys Thr Ile Thr
 65 70 75 80
 Ile Thr Asp Asn Gly Ile Gly Met Ser Arg Glu Glu Val Gln Asp His
 85 90 95
 Ile Gly Thr Ile Ala Lys Ser Gly Thr Lys Gln Phe Phe Glu Lys Leu
 100 105 110
 Thr Gly Asp Gln Ala Lys Asp Ser Glu Leu Ile Gly Gln Phe Gly Val
 115 120 125
 Gly Phe Tyr Ser Ala Phe Ile Val Ala Asp Lys Val Thr Leu Thr Thr
 130 135 140
 Arg Lys Ala Gly Ala Pro His Asp Gln Gly Val Arg Trp Glu Ser Asp
 145 150 155 160
 Gly Leu Gly Glu Tyr Ser Ile Glu Thr Val Glu Lys Ala Gly Arg Gly
 165 170 175
 Thr Glu Ile Val Leu His Leu Lys Glu Gly Glu Asp Asp Phe Leu Ser
 180 185 190
 Ser Trp Lys Leu Arg Ser Ile Ile Lys Lys Tyr Ser Asp His Ile Ser
 195 200 205
 Leu Pro Ile Ile Met Ser Lys Glu Ile Pro Ala Glu Lys Asp Asp Asp
 210 215 220
 Gly Asn Glu Thr Ala Pro Ala Arg Val Glu Asp Glu Thr Val Asn Ser
 225 230 235 240
 Ala Ser Ala Leu Trp Thr Lys Ser Lys Asp Asp Ile Ser Ala Glu Gln
 245 250 255
 Tyr Asn Glu Phe Tyr Lys His Val Ala His Asp Phe Gln Asp Pro Leu
 260 265 270
 Val His Val His Ser Lys Val Glu Gly Thr Asn Glu Tyr Thr Leu Leu
 275 280 285
 Leu Tyr Val Pro Gly Arg Ala Pro Phe Asp Leu Trp Asp Arg Asp Ala
 290 295 300
 Lys His Gly Val Lys Leu Tyr Ile Lys Lys Val Phe Ile Thr Asp Asp
 305 310 315 320
 Ala Glu Gln Leu Met Pro Arg Tyr Leu Arg Phe Val Arg Gly Ile Val
 325 330 335

Asp Ala Asp Ser Leu Pro Leu Asn Val Ser Arg Glu Ile Leu Gln Gln
 340 345 350
 Ser Lys Gln Ile Ser Ala Ile Lys Ser Gly Ala Val Lys Lys Val Leu
 355 360 365
 Gly Met Leu Glu Asp Met Ala Glu Asn Asp Val Glu Lys Tyr Gln Lys
 370 375 380
 Phe Trp Glu Gln Phe Gly Asn Val Ile Lys Glu Gly Pro Ile Glu Asp
 385 390 395 400
 His Lys Asn Lys Asp Arg Ile Ala Asn Leu Leu Arg Phe Ser Ser Thr
 405 410 415
 His Ser Asp Asp Lys Thr Gln Asn Val Ser Leu Ala Asp Tyr Val Ser
 420 425 430
 Arg Met Lys Glu Gly Gln Asn Lys Ile Tyr Phe Ile Thr Ala Asp Ser
 435 440 445
 Tyr Ala Ala Ala Lys Asn Ser Pro His Leu Glu Val Phe Arg Lys Lys
 450 455 460
 Gly Leu Glu Val Leu Leu Leu Thr Asp Arg Ile Asp Glu Trp Leu Val
 465 470 475 480
 Ser Ser Leu Thr Glu Phe Asp Gly Lys His Met Gln Ser Ile Ala Lys
 485 490 495
 Gly Glu Leu Asp Leu Asp Lys Phe Asp Ser Glu Glu Glu Lys Lys His
 500 505 510
 Gln Glu Glu Val Ser Lys Asp Phe Glu Ser Val Val Lys Gln Ile Gln
 515 520 525
 Glu Val Leu Lys Asp Lys Val Ser Glu Val Lys Ile Ser His Arg Leu
 530 535 540
 Thr Asp Ser Pro Ala Cys Leu Val Thr Gly Ala Tyr Asp Met Ser Leu
 545 550 555 560
 His Met Glu Arg Ile Met Lys Glu Ala Gly His Ala Met Asn Met Met
 565 570 575
 Gly Met Gly Gly Ser Lys Pro Ile Phe Glu Ile Asn Pro Asp His Ala
 580 585 590
 Ile Val Gln Ala Leu Lys Asn Glu Gln Asp Asp Thr Arg Phe Ala Asp
 595 600 605

Ile Ser His Ile Leu Phe Asp Gln Ala Ile Leu Ser Glu Gly Gly Gln
 610 615 620

Leu Asp Asp Pro Ala Ala Phe Val His Lys Leu Asn Gly Leu Leu Gln
 625 630 635 640

Gly Leu Leu Lys

<210> 12
 <211> 650
 <212> DNA
 <213> Methylomonas sp. 16a

<220>
 <221> misc_feature
 <222> (541)..(543)
 <223> ATG start site of heat shock protein (htpg) gene

<400> 12
 tacgttgggtg ctatatgtgc tctgactgcc gtcaaccgtc acctgccagc ctgctggaac 60
 attgcctttg ccgtttttga cattaccggt gatgttgccct ttgccgtaag acagcagtgt 120
 atcggcgtca ttgtcgctac cggaaaagaa actggtcgaa tcaaaggtaa aggttcgggt 180
 ggcgtccgcg atatccgtcg tgtaagcaaa tgccgaacta cttgcgcagc tcatcgcaaa 240
 aagtaatgcc gttatggact tggttttcat ctttgttttt ctctttttga aacaagattg 300
 cgccatagtc tactgattca accaaacgcg aactattgcc caatagtatg aatgattttt 360
 gcgttgaaat cgcggcgatt ctcttagggc aggttagcta tttcagagaa tgggtcagat 420
 ttgttttacgg gcagagcggg aatcgtgtaa tccatcggtt tttttaaatg tggccttgaa 480
 aaacgccagt gctatcccca aatcgcagca gtccgatttt taactttcaa gagaccacac 540
 atgactgttg aagcaaaaaa agaaacctta ggctttcaaa ccgaagtga gcatctgttg 600
 catttgatga ttactcgct atacagcaac aaggaaatct tcctgcgcga 650

<210> 13
 <211> 267
 <212> DNA
 <213> Methylomonas sp. 16a

<400> 13
 atgatcaaca aagctggttt tcaacgacta attctgatct tcaggtcgcg cctcacttat 60
 agcgataaaa atcctggagg aaacatgcaa caactcgatt tgcgcatagt cgggaaaacc 120
 gcggccttgt tggctggtgg ctttctgagc gtggcgcaac ccgcatcggc gaacaaggag 180
 ctggaacagc tctccaagca aaacaccaac tgggtcatgc aaaccaaaga ttacgcatcg 240
 acccatttca gcgaaatgat cgacatc 267

<210> 14
 <211> 89

<212> PRT

<213> Methylomonas sp. 16a

<400> 14

Met Ile Asn Lys Ala Gly Phe Gln Arg Leu Ile Leu Ile Phe Arg Ser
 1 5 10 15

Arg Leu Thr Tyr Ser Asp Lys Asn Pro Gly Gly Asn Met Gln Gln Leu
 20 25 30

Asp Leu Arg Ile Val Gly Lys Thr Ala Ala Leu Leu Ala Gly Gly Leu
 35 40 45

Leu Ser Val Ala Gln Pro Ala Ser Ala Asn Lys Glu Leu Glu Gln Leu
 50 55 60

Ser Lys Gln Asn Thr Asn Trp Val Met Gln Thr Lys Asp Tyr Ala Ser
 65 70 75 80

Thr His Phe Ser Glu Met Ile Asp Ile
 85

<210> 15

<211> 696

<212> DNA

<213> Methylomonas sp. 16a

<220>

<221> misc_feature

<222> (501)..(503)

<223> ATG start site of methanol dehydrogenase (moxF) gene

<400> 15

gcgccgatg ctttcgaatc cgccaagacc gggcatggat aaatccatga ccaccacatc 60
 gggcaattgc tttgaataga gttggcaagc ggtctcgcca cgatcggctt catagatctc 120
 gccgatacga tccgacagcg atagataggt cttgtagccg gtacgaacca cggcgtgatc 180
 atctaccaat aaaacgctga ttttactcgc cactggaaaa tttcctcctc aggtcgtcaa 240
 gggataaaga tatgggacaa gtccagtctg atgccaggcg gacttggtgt gccttttttt 300
 atgatgacgc tttatccgtg cttaaaccat gggagctttt cccgtttcca atttcgatcc 360
 ttggcgagat aggaatatct ccgtgcatga ttgcgtcgat ttcacatcga tttcatggat 420
 tgttccgtaa cgttagccag cccggcttct ataacatttg cgccagcgtg gcctgggtgg 480
 cggttaacccg tgatgcggtt atgatcaaca aagctggttt tcaacgacta attctgatct 540
 tcaggctcgc cctcacttat agcgataaaa atcctggagg aaacatgcaa caactcgatt 600
 tgcgcatagt cgggaaaacc gcggccttgt tggctggtgg ctttctgagc gtggcgcaac 660
 ccgcatcggc gaacaaggag ctggaacagc tctcca 696

<210> 16

<211> 645

<212> DNA

<213> Methylomonas sp. 16a

<400> 16

```

atggcaagac cattaattca aatggcggtg gattcactgg atttcgacca aaccgtggca      60
ttggcggatc aagtggcgcc atatgtggat atttttgaaa tcggtacccc ttgcatcaaa    120
tacaacggta tcaacctggt taaagcggtg agagaacggt accctgacaa actgttgctg    180
gttgacctga aaaccatgga cgctggcgaa tacgaagccg gtgcattcta tgccgctggt    240
gccgacatct gcaccgtatt ggggtgtgtct ggtctggcta ccatcggtgg cgtcatcaag    300
gctgcgaaaa aacacgcggc cgaagttcaa gttgacctga tcaacgtgcc gaacaaagca    360
gagtgcgcac gcgaatctgc aaaattgggc gcgcaaata tgggcgttca caccggtctg    420
gacgcgcaag ccgcgggtca aacccccatt accgacctga atgaagttgc ctccttgggc    480
ttgaacgttc gtgtttctgt tgctggcggt atcaaacctg cgactattga tcaaaccgtt    540
aaagcggggc caaacatcat cgttgtcggc gcagcgatct acggtgcgcc gtcacctgcc    600
gaagcagcgc gtgaaattcg tgaattggta gaagcagcag cggtg                        645

```

<210> 17

<211> 215

<212> PRT

<213> Methylomonas sp. 16a

<400> 17

```

Met Ala Arg Pro Leu Ile Gln Met Ala Leu Asp Ser Leu Asp Phe Asp
1           5           10           15

```

```

Gln Thr Val Ala Leu Ala Asp Gln Val Ala Pro Tyr Val Asp Ile Phe
          20           25           30

```

```

Glu Ile Gly Thr Pro Cys Ile Lys Tyr Asn Gly Ile Asn Leu Val Lys
      35           40           45

```

```

Ala Leu Arg Glu Arg Tyr Pro Asp Lys Leu Leu Leu Val Asp Leu Lys
      50           55           60

```

```

Thr Met Asp Ala Gly Glu Tyr Glu Ala Gly Ala Phe Tyr Ala Ala Gly
65           70           75           80

```

```

Ala Asp Ile Cys Thr Val Leu Gly Val Ser Gly Leu Ala Thr Ile Gly
      85           90           95

```

```

Gly Val Ile Lys Ala Ala Lys Lys His Ala Ala Glu Val Gln Val Asp
      100           105           110

```

```

Leu Ile Asn Val Pro Asn Lys Ala Glu Cys Ala Arg Glu Ser Ala Lys
      115           120           125

```

```

Leu Gly Ala Gln Ile Met Gly Val His Thr Gly Leu Asp Ala Gln Ala
      130           135           140

```

CL1747 USNA.txt

Ala Gly Gln Thr Pro Phe Thr Asp Leu Asn Glu Val Ala Ser Leu Gly
145 150 155 160

Leu Asn Val Arg Val Ser Val Ala Gly Gly Ile Lys Pro Ala Thr Ile
165 170 175

Asp Gln Thr Val Lys Ala Gly Ala Asn Ile Ile Val Val Gly Ala Ala
180 185 190

Ile Tyr Gly Ala Pro Ser Pro Ala Glu Ala Ala Arg Glu Ile Arg Glu
195 200 205

Leu Val Glu Ala Ala Ala Val
210 215

<210> 18
<211> 500
<212> DNA
<213> Methylomonas sp. 16a

<220>
<221> misc_feature
<222> (210)..(212)
<223> ATG start site of 3-hexulose-6-phosphate synthase (hmps) gene

<400> 18
ttcgggaatcc ctgacgggaa ttggcccgaa gaaggcagat gccatcggtc agtatcgaaa 60
ggaacatggg gattttcagt cattgaagga tctggagaat gtcagcggca ttggcgagaa 120
aacccttcag gccaatgaaa aagacattcg cttcacggat gatttgagcg ataagtcatc 180
cgcggaaaaaa ggtgcggtag ctgtggataa aaaaggcgcc agatagtaag cgctaaggat 240
tggggtgctg cgccggctgc ggcggcgctc ctcgacggca gagttggtgc caggttggcg 300
gatgattgat gccgaatatt acgcgaccaa ttctcgaggc aaatgaactg tgagctactg 360
agttgcaggc attgacagcc atcccatttc tatcatcacag ttacggacgc atcacgagta 420
ggtgataagc ctagcagatt gcggcagttg gcaaaatcag ctattactaa taattaaaaa 480
ctttcggagc acatcacatg 500

<210> 19
<211> 32
<212> DNA
<213> Methylomonas sp. 16a

<400> 19
caggatccgc gccgtatgct ttcgaatccg cc 32

<210> 20
<211> 34
<212> DNA
<213> Methylomonas sp. 16a

<400> 20

CL1747 USNA.txt

caggatcctg gagagctggt ccagctcctt gttc 34

<210> 21
 <211> 22
 <212> DNA
 <213> *Methylomonas* sp. 16a

<400> 21
 cccatggggt cggaatccct ga 22

<210> 22
 <211> 35
 <212> DNA
 <213> *Methylomonas* sp. 16a

<400> 22
 ggaattcctc ctctccgaaa gtttttaatt attag 35

<210> 23
 <211> 27
 <212> DNA
 <213> *Pantoea stewartii*

<400> 23
 cggaattccc gccctgccac tcatcgc 27

<210> 24
 <211> 51
 <212> DNA
 <213> *Pantoea stewartii*

<400> 24
 ccagaatgag atcatagtgc ggttgcatgc agcatcctta actgacggca g 51

<210> 25
 <211> 51
 <212> DNA
 <213> *Pantoea stewartii*

<400> 25
 ctgccgtcag ttaaggatgc tgcattgcaac cgcactatga tctcattctg g 51

<210> 26
 <211> 33
 <212> DNA
 <213> *Pantoea stewartii*

<400> 26
 gcgaattcgc tagcggctag atcgggctg gcc 33